

SKIN GRAFTING OF THE HEEL: BY MEANS OF A FLAP FROM THE OPPOSITE THIGH.*

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THE condition that in this case made a skin grafting operation of the heel necessary, was not only a defect of the skin proper, but a loss of the subcutaneous fat, which not only acts as a buffer for the bone, but also, by interposing a soft cushion between it and the skin protects the latter from injury. When we consider the anatomical relations of the heel, formed as it is by the os calcis, a very strong bone, and its muscular and ligamentous attachments, and covered by this cushion of fat and skin, it is easy to understand the reason why in crushing injuries of the foot, the soft parts are frequently torn away from the bone without injury to the latter. This separation may be complete at the time of injury, or may take place later as in the case to be reported, owing to infection or insufficient blood supply of the torn soft parts. When such separation does take place, the heel is practically formed by the os calcis, to which, when the parts are healed, the new skin becomes intimately adherent. This new skin, even though healthy, cannot long resist the injury to which it is daily subjected, and soon breaks down and ulcerates. For this reason this patient, who has had such a crushing injury of the foot, came to us; and it was imperative, not only to remedy the skin defect, but also to furnish, if possible, a new cushion of fat. This cushion is not furnished in the ordinary methods of skin grafting, such as the Reverdin and the Thiersch. The new skin in such methods also becomes intimately adherent to the bone and will not long remain intact. The only way the heel can be covered and furnished with a new cushion is by

* Read, and case shown, before the Jefferson Co. Med. Soc., Sept., 1908.

some sort of a flap operation, the flap being taken from a part of the body which naturally has a thick layer of subcutaneous fat.

Numerous methods of flap grafting have been devised for different parts of the body. Among the best known is the Italian method of covering defects of the nose by means of a flap from the arm, the hand being placed on the head and held in that position until healing takes place. Skin defects of the hand are frequently covered by flaps with two pedicles from the abdomen or back. Defects of the leg have been covered by a flap taken from the opposite leg. In all of these, the object is merely to secure healthy skin, that is pliable and will not contract. In this case, however, it was necessary, as already stated, to furnish a fatty cushion besides covering the heel and as the results were fairly good it was deemed of sufficient interest to report.

The following report consists of a short history and a description of the condition of the foot, together with the various steps of the operation as it was performed:

H. K., age eighteen, referred to me by Dr. T. F. Shinnick, Watertown, Wisconsin. Twelve years ago while flipping a train got his left foot caught between the air brake and the wheel. The injuries of the foot sustained at that time as near as can be ascertained were as follows: The soft parts were torn from the bone from a little below the ankle down to the toes. The foot was literally stripped of its flesh down to the toes but the ankle joint was not injured. The tarsal bones, the os cuneiform and the cuboid, *near their articulation with the metatarsal bones*, were either fractured or dislocated, as were also some of the phalanges. The parts were restored as nearly as possible and the skin sutured. In healing, a great deal of the skin became gangrenous and had to be cut away. So much for the injury.

The examination of the foot at the time of the operation showed that there is a slight limitation of motion in the ankle-joint, especially of flexion, it being limited to ninety degrees. Beginning a little below the ankle-joint, the foot is (Fig. 4) covered by scar-tissue which is smooth and shiny but somewhat dis-

colored. It hugs the bony skeleton very closely but is quite pliable, except over the heel where the scar is intimately adherent to the bone. This scar-tissue extends on the dorsal surface as far forward as the base of the toes, and on the sole of the foot it covers the heel. Laterally it extends in an irregular manner down almost to the sole; over the cuneiform and cuboid bones and the proximal ends of the metatarsal bones, irregularities can be seen and felt which are either callosities, the result of fracture or slight dislocations of the bones themselves. The arch of the foot is not broken down, but the tarsal and tarsometatarsal joints are ankylosed. The toes are considerably crippled; the fourth and fifth are dislocated forward at the metatarsal phalangeal joints, and the distal phalanx of the third backward, giving that one the appearance of a hammer toe. Motion such as flexion and extension is entirely lost, except in the great toe and the second toe, where it is very much impaired. All the other functions of the foot are quite well preserved. The skin of the heel, as already stated, is very intimately adherent to the bone. Scattered over the heel are numerous ulcers of different sizes which have persisted almost continuously since the injury and from which he seeks relief.

Operation, March 31, 1908. The preparations for the operation were very thorough. The patient was put to bed for four days and the leg and foot were shaved and repeatedly scrubbed with soap and water and warm bichloride dressings 1:2000 applied every four hours. The opposite thigh was also shaved and thoroughly scrubbed and warm bichloride dressings applied; just previous to the operation, the parts were again scrubbed and dressings of normal salt solution applied; nothing but normal salt solution was used for the hands and for the sponges after the preliminary preparation had been made.

The operation consisted in first denuding the heel by means of a scalpel of all its scar-tissue. The surface denuded was approximately two and one-half inches in width by three and one-half in length. It was then curetted and particular attention paid to hæmostasis. All bleeding was stopped by means of pressure and torsion and sponges wrung out in hot saline solution. After all the bleeding had been stopped, a dressing of normal salt solution was applied.

The second step of the operation consisted in raising a flap

on the opposite thigh. This flap was about four and one-half inches in length and about three and one-half in width (Fig. 1). The outlines of it had been marked on the thigh by means of a silver nitrate pencil and were obtained previous to the operation in the following manner: A sheet of paper was folded snugly over the right thigh (the thigh was selected on account of the thickness of the subcutaneous fat) and the left foot was then brought into position (Fig. 2). A flap was then cut in the paper and the heel covered with it. This was repeated several times and the pattern selected which seemed to fit the heel most accurately. The incision was commenced at about the middle of the anterior surface of the thigh, about nine inches below the anterior superior spine of the ileum, and was continued downward and a little outward for a distance of four and one-half inches. Another incision at right angles to the first commenced at its lower end and was directed outward and a little upward for three and one-half inches. These incisions were not straight lines but somewhat curved to fit the corresponding edges of the denuded heel (Fig. 1). They were made down to the muscle and the flap included between them was raised. The skin and subcutaneous fat were further undermined to such an extent that the flap, when complete, would correspond to a rectangle of which the two incisions formed the inner and lower sides. Perfect hæmostasis of it and the denuded thigh was also sought and they were compressed for a short time with hot saline solution.

In the third step of the operation, after covering the denuded surface of the thigh with rubber tissue, the parts were brought in position (Fig. 2) by flexing the left leg at the knee and applying the foot to the thigh in such a manner, that the denuded surface of the heel would be completely covered by the flap. In this position the corresponding edge of the flap and denuded heel were carefully approximated by means of lead plates and silkworm gut, the left or inner margin of the flap to the upper or right edge of the heel, and the lower margin of the flap to the anterior edge of the heel. When this was done, by slightly moving the foot outward, the flap was made to roll over and hug the heel very closely. At a point a little to the left of what would eventually become its right border, the flap was now sutured by means of lead plates and catgut to the left edge of the denuded heel. After a copious dressing of gauze wrung out in warm saline

FIG. 1.



Shows the general outlines of the incision and the scar left on the thigh.

FIG. 2.



Shows the position in which the leg was held by the plaster cast. This position was not painful to maintain and there was no special difficulty when the leg was released.

FIG. 3.



Shows the condition of the heel two months after operation. The new heels look like a patch that had been pasted on.

FIG. 4.



A profile shows that the greater part of the foot is covered by scar tissue and that the new heel has considerable thickness. It also shows the scar and what remained of the attempt to jump a flap.

solution and cotton, the foot was held in position by means of adhesive strips and a plaster cast (Fig. 2). The first dressing was allowed to remain in position for six days. At the end of this time, owing to the odor, a window was cut in the cast and the parts carefully cleansed and dressed. At this time it was noted that the flap looked healthy and had grown firmly to the heel.

The fourth and fifth step of the operation consisted in cutting the pedicles with a pair of scissors; the upper one on the seventh day and the lateral one on the ninth day.

Remarks.—At the time of the first dressing on the sixth day, the flap was firmly adherent to the heel. On the ninth day, it was freed from the thigh by cutting its lateral pedicle, because it was thought that a sufficient length of time had elapsed to enable it to get its nourishment from the heel. Shortly after this pedicle was cut, it became very congested with venous blood. This congestion gradually disappeared about the fourth or fifth day. At about the same time it was noticed that a small strip had become gangrenous. This strip was about one and one half inches in length and about one half inch in width, and was situated along its outer border. The whole thickness of the flap did not become necrotic but only a very small strip about one eighth of an inch in width at its extreme outer edge, where it had not become adherent to the denuded heel. This strip was cut away and after the parts had become healthy, an attempt was made to cover it by jumping a flap from the outer aspect of the ankle. This procedure was an entire failure. The portion of it, which was to cover the heel died, and the remainder was turned back into its original place. The scar caused by this operation can be seen in Fig. 4. Some time later, when the wound of the thigh where the flap had been removed, was being covered with Thiersch grafts, a few were also placed on this part of the heel to expedite healing. The patient was discharged from the hospital May 18, about two months after his admission. At that time the heel was entirely covered but the wound of the thigh was only partially healed.

The condition of the heel at the present time, almost two

months after the operation is very satisfactory. The patient is an active young man, and has been on his feet a great deal, but as yet there has been no recurrence of the ulcers. The skin is pliable and furnished with a good cushion of fat. Pressure does not cause any pain and he is able to bear his weight on it. The appearance of the heels is quite remarkable. The skin covering it stands out in marked contrast to the other parts of the foot and its borders are very well defined. Fig. 3. It still retains its characteristic appearance, being covered with hair and retaining its fat and looking as though it was a patch which had been pasted on the heel. The interesting feature of this case is, of course, the cushion of fat which was furnished in this method of skin grafting and which was about three fourths of an inch in thickness at the time of operation.

The question, of course, arises, will the result be permanent or will the fat atrophy? Can the fat of the heel which is of a fine granular variety with a great deal of connective tissue interspersed, be replaced by ordinary subcutaneous fat from another part of the body? This question, of course, can only be answered after a sufficient length of time has elapsed.